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ABSTRACT

This document is a review of the work being done in the area of energy and the economy. The authors believe that increased energy efficiency, plus transition to a solar economy, can actually lead to a more stable economy and to more jobs than the large-scale system scenario, which corporate energy interests, many industrialists, and some government agencies, are promoting. The document includes the following sections: (1) energy and the economy; (2) substitution of energy for labor; (3) productivity and jobs; (4) energy growth and prosperity-the myth; (5) energy inefficiency and waste; (6) capital investment; (7) energy efficiency and jobs; (8) solar, wind, and biomass conversion; and (9) the politics of solar energy. Extensive footnotes are given. (TM)

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JOBS & ENERGY

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GUIDE TO JOBS AND ENERGY

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and Gail Daneker.

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Jobs and Energy

Introduction

Corporate energy interests, along with most industrialists and some agencies of the government, are vigorously urging the rapid expansion of energy production. The energy systems they are promoting are large in scale, technologically complex, costly, wasteful, environmentally destructive and dangerous to energy industry employees and the public.

An increasing number of Americans are becoming convinced that these systems—such as nuclear fission and fusion, conversion of coal and shale to gas and oil, expanded coal-fueled electric generation— are *too destructive* to the public's health—as well as to workplace and natural environments—to be acceptable. These citizens propose instead a large decrease in the nation's waste of energy, plus immediate commercialization of proven solar energy technologies and development of solar technologies almost ready to be commercialized.

Most proponents of the large-scale, complex energy systems concede the systems they are promoting expose the public to a variety of dangers. But, they contend, there is absolutely no other possible way to meet the nation's energy needs, to provide for a strong economy, and to create sufficient numbers of jobs.

Environmentalists For Full Employment disagrees; there *is* another way.

The increased energy efficiency plus solar energy choice *can* provide sufficient energy for a prosperous economy. In fact, such a solution to the nation's energy problem *actually leads to a more stable economy and to more jobs* than does the large-scale system scenario. It does so with less pollution, less disease, less social disruption, and less interference with community, labor union and individual rights.

Decisions on the nation's economic, energy and employment futures are being made now. Wrong decisions today will be irreversible: if the nation decides to pin its hopes on inefficient, large-scale energy systems, such a vast quantity of resources and money will be consumed and so much havoc will be generated through all levels of society that energy and job options for the future will be choked off.

In sum, a future based on the visions of America's giant energy corporations and some of the federal agencies charged with planning energy strategies will be neither prosperous nor safe. Americans need to know this; and they need to know there is an alternative approach which will provide the nation with safe energy, with prosperity and with jobs.

For these reasons, *EFFE* has prepared this "Guide to Jobs and Energy."

I. Energy and the Economy

The latest recession is the 6th since World War II. It is the most severe.[1] Total real unemployment is between 8% and 10%. Women, minorities and young people are out of work in even higher percentages. In the last year, incomes of three million additional Americans fell below the "poverty line." Rural poverty has increased. The nation's largest cities have been experiencing severe financial crises, and have cut back a broad range of vital human services.[2] Industry has been operating at less than full capacity, and inflation has cut deeply into most wage increases of the past decade.

Americans have long been told that ever-increasing energy production was the key to national economic well-being and jobs. It seemed enough to note that as energy production expanded over the years, so did economic growth and total employment. Many in government and industry—in the Energy Research and Development Administration (ERDA), in the Federal Energy Administration (FEA), in Congress, at the Edison Electric Institute, the Atomic Industrial Forum, the oil companies—are therefore advising that unemployment can be ended only by stepping-up energy development to the greatest degree possible, and with the largest systems possible.

Yet, current high unemployment, along with a succession of economic crises, have been taking place *while national energy use has been at an all-time high, and increasing.*

The widening gap between accepted theory and reality has prompted calls for re-evaluation of the relationships between energy expansion, economic health and jobs. Cass Alvin, Director of Public Relations and Education for the United Steelworkers of America, reflected this new outlook recently when he told a Los Angeles Federation of Labor (AFL-CIO) meeting which had been listening to threats of job loss delivered by California utility executives:

> I think we've got to deal with the nature of energy and jobs very carefully, or we'll find ourselves looking to the wrong allies when confronting energy issues. . . .[3]

And an economist in the research and education department of the International Woodworkers of America (AFL-CIO/CLC) has warned in a similar vein:

> Unions risk disaster and perform a disservice to their members if they do not attempt to define [energy and job relationships.][4]

It sometimes appears deceptively easy to determine which event causes another, especially when there are some apparent connections. For example, some wags have pointed out that over the years there has been a direct correlation between the salaries of a certain denomination of ministers in Massachusetts and the price of rum in Cuba.[5] Yet, no one seems to be suggesting that a real connection exists between these two occurrences. Similarly, along with energy growth during this century there has been an increase in mental illness. But it is not likely that advocates of energy expansion would say that such tragedy is connected to or necessary for continued energy growth.

To probe the nature of energy-employment relationships, it is instructive to begin with a look into the manner in which energy has been used.

II. The Substitution of Energy For Labor

Historically, industry has sought to substitute energy for human labor. The amount each working person could produce has therefore increased steadily. But after substitution of energy for labor in each process, the total number of workers needed *decreased*. The only way the total number of workers could increase would be if there were also a rise in the demand for products. In other words, more jobs would have to be created by the increased demand than were eliminated by the energy substitution.

For instance, assume the Lutkus Felt Company discovered it would increase profits by replacing most of its employees with machinery (which involves investment of energy, resources and dollars). Once the machinery is installed, Lutkus

can lay off its employees. Rival felt companies need to stay competitive with Lutkus: they also automate and lay off employees.

So after Lutkus and its competitors have finished installing their new machines, the result is:

1. energy consumption in the felt industry is up;
2. employment in the felt industry is down.

Such has been the pattern of American industrial development. (See Art Buchwald's satirical analysis, page 3.) What has kept the "more energy leads to more jobs" myth alive has been that accompanying a growing population has been a very large increase in the use of goods and services per person. There has also been a significant increase in energy use. It has thus *appeared* as if energy expansion had been causing economic expansion and increases in jobs. But *constantly expanding demand* has led to constantly expanding production and employment. As Louisiana State University's Professor Herman Daly has concluded:

> Clearly, what is responsible for increasing total employment is the increase in total [goods and services], not the increase in inanimate power production, which by itself must decrease employment.[6]

III. Productivity and Jobs

From industry's point of view, energy and investment dollars have been preferred to human labor. Automated equipment does not complain about unsafe working conditions, seek wage hikes, question the nature of jobs or products, or strike. And energy has been cheap, subsidized by the government and by the American people.

Goods-producing industries have therefore sought to use fewer workers (or at least make their employees work faster). Their goal has been to increase output per worker, or "productivity." This has caused total employment in the manufacturing sector to decline over the last 40 years. Organized labor has supported this emphasis on "productivity," and has allowed the wage scales of skilled labor to be linked to the "productivity index." To management, this index is an important indicator of how well an industry is performing.

But as Hazel Henderson has pointed out, the "productivity index" is really an "automation index"—a guide to tell management how well it is doing in its drive to get rid of employees. Thus, as more and more energy is substituted for labor, automation increases and jobs decrease (unless there is an accompanying switchover to shorter work days, and a basic redistribution of wealth with increased consumer access to goods and services). The "productivity index" goes up, and management knows it is being successful.

Labor's acceptance of "productivity"—that is, automation—as a criterion for wage increases has resulted in a widening of the earnings gap between those employed in high energy industries (who are members of well-organized, powerful unions) and those working in areas where energy (and skill) requirements are low (and whose unions are less powerful).[7]

It has also resulted in the need for more and more energy, and in a *decrease* in the total number of industrial jobs. In 1971, the five largest manufacturing industries (primary metals; stone, clay and glass; food; chemicals; and paper) provided only 7.3% of the nation's jobs. From 1950-1970, there had been no employment growth in these industries; yet their gross energy consumption during these years increased greatly.[8]

In the steel industry from 1949—1969, the number of production jobs decreased by 20%, while steel output increased by 45%.[9]

The aluminum industries in the Pacific Northwest provide a particularly glaring example of high-energy, low job ratios. According to the Bonneville Power Administration, this industry consumes 25% of the region's electricity, and provides but *one-half of one percent* of the total jobs in that region.[10]

In the agricultural sector, the use of energy—for fertilizers, chemicals and automated equipment—increased the output per worker. But this increase in "productivity" led to a steep decline in the number of people employed. In 1970, agricultural employment was less than half of what it had been in 1920. That year, about 27 billion person-hours of labor were needed, compared with only about 2 billion person-hours 50 years later. Energy input increased more than 4 times over that period.[11]

Between 1950 and 1971, total national employment increased 41%, while jobs in the energy-producing industries increased only 5.5%.[12] And this small increase over twenty years was due primarily to expanded gasoline station employment. (Today, most of these jobs are vanishing, being replaced by customers and self-service gas pumps.)

From 1961-1973, electric utilities increased their kilowatt output about 130%, their revenues about 260%, their construction costs about 340%. But *employment* in electric utilities increased only 21%.[13]

Bruce Hannon, at the University of Illinois' Center for Advanced Computation, has calculated the relative amounts of energy and the units of labor reflected in consumer purchases for 1971. The following table shows that for each consumer dollar spent on electricity, 502,473 British Thermal Units (BTUs) of coal, gas or oil were required. But only 44/1000 of a job unit was necessary. Gas and oil purchases reflect *similarly large energy requirements* per dollars spent by the consumer, and *relatively small* units of labor.

These figures contrast sharply with those relating to expenditures for other categories listed—such as women's and children's clothing, or furniture. These purchases needed far less energy than did production of electricity, gas or oil, and utilized more units of labor per dollar spent:

TABLE I

ENERGY AND LABOR INTENSITIES OF PERSONAL CONSUMPTION ACTIVITIES, 1974[14]

personal consumption expenditure	*energy intensity (BTUs per dollar)*	*labor intensity (labor units per dollar)*
electricity	502,473	.044
gasoline and oil	480,672	.073
kitchen and household appliances	58,724	.073
new and used cars	55,603	.078
food purchases	41,000	.085
furniture	36,664	.092
women's and children's clothing	33,065	.100
religious and welfare activity	27,791	.086
telephone and telegraph	19,043	.055

In all, the major energy-producing and energy-using industries consume ⅓ of the nation's energy. Yet they directly provide only about 10% of the nation's jobs.[15] Energy companies claim that *indirect* employment created by energy is substantial. But as Professor Daly points out, *any* investment—even in welfare and unemployment compensation—leads to indirect job creation. And as noted above, energy, once available, *generally ends up replacing jobs.*

Where have the new jobs come from? Since World War II, new jobs have been created overwhelmingly in the merchandising and service sectors of the economy. Between 1947 and 1970, employment in these areas increased 95%.[16] These jobs have required relatively low amounts of energy, capital and

Moving the American Economy

by Art Buchwald

. . . Rootin' Motors is visited by a salesman from Glutton Machinery. The salesman explains to Rootin' that Glutton can now provide machinery that will do the jobs of 1,000 men at a saving of $5 million a year. The president of Rootin' is impressed and decides to install the machinery. A year later the pink slips go out and 1,000 men, including Laidlaw, get one.

The president of Rootin' makes a speech to the departing men and women telling them he is sorry about the layoffs but there was no way Rootin' could stay in business if it did not install the new equipment.

While the new machinery helps Rootin' make 200 more Dolphins a day, sales are way off. The president calls in his dealers. "Why aren't the Dolphins moving?"

"Because Laidlaw is still looking for a job," one of the dealers says.

"Who is Laidlaw?" the president asks.

"He's one of the men you fired when you installed new machinery so you could be in a competitive position in the economy."

"All right," says the president. "Let's forget Laidlaw. Aren't there other customers out there for our Dolphins?"

"Streeter was, but he bugged out."

"Who is Streeter?"

"He's a bricklayer who was laid off when Laidlaw decided not to build a new house because he didn't have a job. When Streeter was laid off after Laidlaw was fired, Feldman canceled his Dolphin."

"Feldman?"

"The furniture man who was going to sell Mrs. Laidlaw a new dining room and living room set. Not only did Feldman cancel his Dolphin, but he told his brother-in-law not to buy one either, because they were laying off men at the Rootin' plant which was a sure sign of a recession."

"Just when we can make Dolphins at a price people can afford," the president of Rootin' moans, "no one can afford them anymore."

"Wait a minute. What about all the people at Glutton Machinery?" a dealer says. "They're all working."

"Of course," the president replies. "Why didn't we think of them?"

The president of Rootin' calls the president at Glutton and says, "How many people do you have making the machinery you sold us so we could lay off 1,000 men?"

"We had 5,000," the Glutton president says. "But then the Robot Tool Company installed a new plant for us and now we have four. Why do you ask?"

"We're trying to get someone to buy our Dolphins."

"I wouldn't call Robot. They recently developed a new assembly line which requires the services of just one man, and they're waiting for him to retire in six months so they can replace him with a computer."

The president turns to his dealers. "Okay, we have the best factory in the United States but no customers for our cars. What do we do?"

"Why don't you hire back Laidlaw?" someone suggested.

"We can't afford him," the president shouts.

"Maybe instead of hiring Laidlaw back we can give him a tax cut. Then he'll want to buy a car again."

"Laidlaw doesn't pay taxes," the president says. "He's on unemployment. We've got to find a job for Laidlaw."

"How?" a dealer asks.

The president says, "That's Carter's problem, not ours."

Source: Washington Post, Dec. 21, 1976, reprinted by permission.

resources. They also have caused less pollution and environmental disruption than industrial jobs.

The drive for increased substitution of energy for labor continues. The chief economist of the U.S. Department of Commerce recently testified before Congress that "productivity" will grow faster during 1976-1986 than in the past decade.[17] Indeed, "productivity" is becoming a factor in the service and merchandising sectors—the very areas which have provided new jobs in the past 30 years. Machinery is replacing supermarket clerks, bank tellers, teachers and telephone operators, in order to increase output per remaining employee and avoid dependence upon human labor. The Bell System, for example, is planning to replace 33,000 operators by installing computerized switching and billing systems, at a net annual savings (to them) of $390 million.[18]

IV: Energy Growth and Prosperity: the Myth

It is for good reason that the public has been led to believe that energy expansion has been the springboard to economic growth, the "good life," and jobs.

Industry has been able to replace human labor economically with energy purchased at very low rates from an ever-expanding energy industry which has been accumulating ever-increasing profits. The small consumer has been picking up the tab: industries traditionally have paid *less* than individual consumers for each unit of energy used. In addition, by bearing most of the environmental and disease costs associated with energy, and by permitting substantial government assistance to energy companies, the public has actually been subsidizing industrial use of cheap energy to replace human labor.

It is thus clearly in the interests of both energy producers and major energy users to continue keeping the public in the dark about energy supplies, production, expansion and use. From their standpoint, it makes sense to dig up the old scare tactic about job loss and economic depression: a line used with much success in the past: against the presidential bid of Populist William Jennings Bryan in 1896, against child labor laws, unemployment insurance, workman's compensation, labor union organizing and pollution control legislation, to cite but a few examples.

Critics of energy policy have been slow to consider the industry-promoted mythology about energy expansion leading to economic prosperity and jobs. But increasingly, reputable organizations and analysts have been examining energy and its relationships to the rest of the economy:

• A number of studies have shown that Americans use as much as two times the energy per person as do West Germans, Swedes and the Swiss. Yet the standards of living in West Germany, Sweden and Switzerland are comparable to or higher than this country's. And unemployment in those European nations is much lower than in the United States. As a recent

Federal Energy Administration report noted:

> This large disparity in energy use between [West Germany and the United States] suggests that continued economic growth and improvement of the standard of living in the United States should be possible without a proportional increase in energy consumption.[19]

• From his studies, Professor Herman Daly has concluded:

> Undeniably, energy is a necessary input to the supplies of nearly all sectors. But it does not necessarily follow that increasing the production of energy will increase the numbers of jobs in those sectors . . . Nor does it always follow that other sectors cannot expand employment without an increase in energy input . . . In general, increasing input of energy to the supply side is neither a necessary nor a sufficient condition for increasing employment.[20]

• A Washington DC-based research group, Resources for the Future, has found that data

> do not support the widely-held belief that energy and Gross National Product (GNP) have grown at essentially the same rates in advanced countries . . . It seems to be questionable to assert a rigid linkage between [the two].[21]

In the latter part of the 19th Century, says this organization, energy use in the United States grew faster than did the GNP. This was because heavy industry was the main factor in national economic growth. But after World War I, when lighter manufacturing plus increasing services began to predominate, energy use increased at a *slower* rate than did GNP.

• The Institute of Ecology, at the University of California at Davis, has concluded that comparison studies of different countries also

> do not support the hypothesis that constantly-increasing energy consumption per capita is a prerequisite to increasing economic growth.

The Institute discovered that energy and employment ratios varied in different industrialized countries, "reflecting fundamental differences between structures of economies." In addition,

> . . . beyond an optimal level of energy consumption per person, further increases in energy use leads to a variety of deleterious effects which ultimately lower growth rates.[22]

• The Ford Foundation's massive Energy Policy Project determined that a less than historical rate of increase in energy expansion, accompanied by more efficient use of this energy, would expand the total number of jobs, and improve public health and environmental quality as well. By the year 2000, according to the report, improved energy efficiencies could actually permit a zero energy growth rate. In fact, the nation would be using almost half as much energy as is currently being projected for that date, and would be experiencing an **increase** in total employment.[23]

• An investigation by the Oak Ridge Institute for Energy Analysis has revealed that energy production could grow at the very low rate of 1.5% through the year 2010 without adversely affecting the economy. The Institute found that there would still be a real GNP growth of between 2.5%-3%.[24] According to *Science* magazine, this study provides "evidence that low-energy growth forecasts are well on their way to attaining the status of conventional wisdom."[25] And a recent study commissioned by ERDA commented that the data developed by the Institute represent

> a significant break with the proportionality between GNP and energy use which has held approximately even for several decades.[26]

• John Myer, in the *Conference Board Record*, a journal which reports to management on business affairs, wrote that industry can use energy more and more efficiently. To Myers, the connection between energy growth and economic growth

> seems to me more elastic than commonly assumed... To the extent that we can cut down on energy use more cheaply than we can expand domestic supplies, the goal of lessened vulnerability to supply interruptions or sudden drastic price hikes can be more economically achieved. This course would also carry the added benefits of less ecological damage and expense of environmental protection.[27]

• Testifying before the Joint Economic Committee of Congress, Lee Schipper and Thomas V. Long stated:

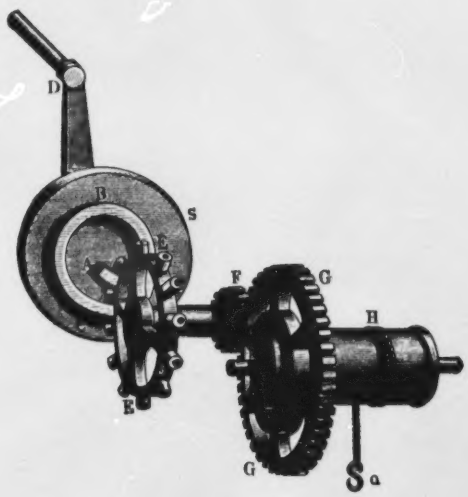
> There does not seem to be an immutable direct proportionality between economic growth and energy use.

Schipper and Long also pointed out that increased capital investment has been substituted for both energy and labor, hence

> energy use has been the tail of the dog, wagged by the interaction of the larger factor costs.[28]

• Even Paul McCracken, a former chairman of the President's Council of Economic Advisors, has confided to *Wall Street Journal* readers his doubts about what the public has been led to believe regarding energy and economic growth:

> the striking thing about the relationship between the rate of growth in output and the rate of increasing energy consumed is not that it obviously exists, but that it is so variable.[29]



Further examination of the myths surrounding energy requires discussions of energy waste, and of capital investment and job creation.

V. Energy Inefficiency and Waste

Individuals waste energy, and there is much each person can do to conserve. But there has been a campaign on the part of the energy industry to mislead the public into believing that the bulk of energy waste is caused by the average citizen who is too lazy to walk, or too pampered to live and work with the thermostat at a low setting.

In fact, energy in this country has been wasted primarily because public and private policies have long promoted energy extravagance in the mistaken belief that this was the best way to achieve a prosperous economy. The "lazy citizen" theory ignores the reality that accurate information on energy matters and alternative methods of energy supply have not been available to the consumer. It also does not take into account that wasteful energy consumption has been encouraged to increase the profits of energy-producing companies.

Jimmy Carter has stated:

> Our energy waste in transportation is 85%; in generating electricity, 65%. Overall, 50% of our energy is wasted.[30]

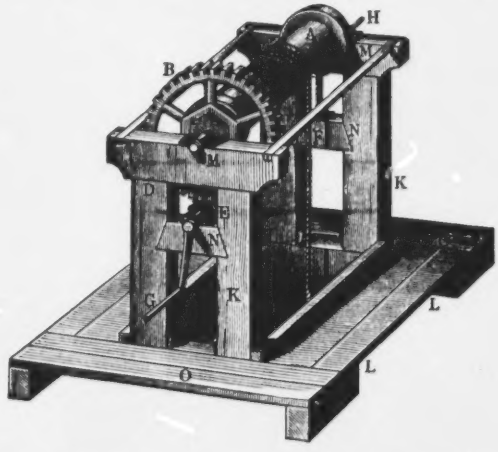
According to Denis Hayes of Worldwatch Institute, Americans wasted more fuel in 1975 than was used by two-thirds of the world's population.

Energy can be wasted during generation, during transmission and at end use. The process of transforming coal, gas or oil to electricity results in the waste of about two-thirds of the energy in the fuel. Conversion of uranium to electricity is even more wasteful. Using coal to make synthetic fuels involves the waste of about one-third of the coal's energy content.

Energy is wasted when it is sent out over long transmission lines, especially over power lines from nuclear power plants which for danger reasons the government has decided must be located far from large concentrations of people. Energy is wasted when appliances and machines are not built to perform at the best possible efficiency levels. Energy is wasted when heavy automobiles with "high performance" engines guzzle fuel to propel the vehicles a few miles per gallon. And energy is wasted when it simply is allowed to leak—through ceilings, walls, pipes, hot water heaters and industrial processes, due to inadequate insulation and design.

Energy is also wasted when it is not matched in "quality" to the intended task. This occurs, for example, when electricity is used for heating buildings and water, and for cooking. Electricity is a very "high quality" and expensive form of energy, most suited to and most economic for special tasks such as rail transportation and some exacting industrial processes. When water is heated by electricity, for example, it is after water at a power plant has already been boiled by the fuel. This fuel, whether fossil, nuclear or solar, has had to boil water to make steam to turn turbines to generate electricity—and in each step there is considerable loss of energy. It is quite apparent that there is a wasteful "mismatch" when nuclear fuel is used to achieve a temperature of several thousand degrees in an expensive and complex reactor in order to boil water to create steam—something which occurs at 212 degrees F. And it makes even less sense to go through all this trouble to heat or cool buildings to 70 degrees when other sources of less troublesome and less expensive heating and cooling are available which utilize air whose temperature is closer to the levels desired. For instance, it has been demonstrated that modern high-rise office buildings could be well-served by heat pumps which move cold air to the warm side of the building exposed to the sun's rays, and return warm air back to the cold side. These heat pumps would replace the waste created by heaters and air conditioning units operating simultaneously throughout the entire structure.

Energy is wasted at industrial sites when steam, which could be reused to generate on-site electricity or put to a variety of successively lower-grade uses ("cascading") is simply released to the atmosphere. Energy is wasted when inaccurate long-range projections lock utilities into building huge, central-station electrical generating plants which are not needed when completed seven to ten years after the decisions to build them were made.



According to Amory Lovins, increased electrical expansion to the 150 quadrillion BTUs by the year 2000 which many in the energy industry and government yearn for, would result in energy waste approximately equal to the nation's total energy consumption in 1971.[31]

And as energy is wasted and thrown away, so are jobs. Bruce Hannon has computed that for each quadrillion BTUs of fuel changed into electricity, 75,000 jobs are lost over the entire economy.[32]

Lastly, all the money invested in wasteful and unnecessary energy production at the expense of other national needs must be considered wasted as well. This is especially serious because money will be in short supply: Lovins doubts whether the nation will even be able to afford to build—or consumers able to buy—all the products which are supposed to be using this wasteful investment in energy.

VI. Capital Investment

The major energy-producing and energy-using industries consume the lion's share of national capital investment.

A recent ERDA report concluded:

> It is probable that the nation's single greatest investment in energy in the future will be in the area of electricity generation, transmission and distribution.[33]

Amory Lovins has calculated that investments in large-scale, centralized energy systems as proposed by people in ERDA, FEA and assorted energy monopolies, would consume three-fourths of all private investment capital in the United States.[34] Estimates of the total amount of money needed through 1985 range from $900 billion to one trillion dollars.[35] The Edison Electric Institute, the public relations arm of the nation's privately-owned utilities, has estimated that these utilities would require $570 billion for construction purposes alone to provide electric power they believe will be necessary over the next fifteen years.[36] The President of Exxon Nuclear Corporation stated last year that at least **half a trillion dollars**

would be needed to build the 500 nuclear power plants he would like to see completed by the year 2000. Another $100 billion, he added, would be required to construct the necessary nuclear fuel cycle facilities." The development of a commercially-usable nuclear breeder reactor, by the latest estimate, will cost $10 billion plus. Storage of radioactive wastes will consume presently-uncalculable billions of dollars over hundreds and hundreds of years (uncalculable because the methods for long-term storage have not yet been devised). The cost of each coal-conversion facility is currently thought to be around $1 billion. Rocky Mountain shale conversion plants will run at least $1 billion each. And the price tag for nuclear fusion electric systems, assuming they can be made commercially available, will be in the billions of dollars.

These large capital investments result in small numbers of very expensive jobs. A 1977 report by *The Conference Board* found that investment to create each job in energy-producing and major energy-using industries was much higher than investment to create a job in areas which use smaller amounts of energy. See Table II:

TABLE II

CAPITAL INVESTMENT PER JOB*

industry	*Capital investment per employee*
petroleum	$108,000
public utilities	105,500
chemicals	41,000
primary metals	31,000
stone, clay, glass	24,000
all manufacturing (average)	19,500
food & kindred products	18,000
textile mill production	11,000
wholesale and retail trade	11,000
services	9,500
apparel and other fabricated textiles	5,000

It is clear from these figures that it takes about 21 times the amount of investment to create a job in the petroleum industry than it does to create one job in the apparel and textile industry. Jobs created by investment in public utilities are the second-most expensive: about $105,500 each. The investment needed to create a manufacturing job on the average is about $19,500, which is about *one-half* of the amount required for a job in the chemical industry, and about *one-third* of what is required per job by the primary metal industry. Investment in "all manufacturing" is about *double* that needed to create a job in wholesale and retail trade, or in the service sectors of the economy.

But despite the huge capital investments required, and the small numbers of jobs created; despite the inefficiencies and the waste of non-renewable fuels; and despite threats to human health and local autonomy, industry promotion of their large-scale, complex energy systems continues. (In the past year, for example, over one-half of all new homes constructed had all-electric heating, cooling and cooking systems.) In attempting to fulfill their own propaganda that prosperity and jobs depend on more and more energy—especially electrical energy—these companies will seek to divert more money and more resources their way to create more waste and more pollution.

There will be continuation of the trend toward fewer manufacturing jobs, greater gaps in wage scales through the entire society, increased environmental destruction and citizen protest. Less money will be available for investments in other areas which serve people's needs, provide more jobs

SOCIETAL EFFECTS OF LARGE-SCALE TECHNOLOGIES

Technologies shape social institutions. The use of large-scale, complex, dangerous energy systems such as nuclear fission and coal conversion affects more than just energy matters. Such installations lead to concentrations of political and economic power, as well as to curtailment of individual freedoms and the democratic process.

A recent Rockefeller Brothers Fund report listed the following "unavoidable consequences" of these kinds of energy technologies:

- compulsory governmental diversion of scarce resources (capital, skills, labor, special sites, water, etc.,) from other priorities into the energy sector;
- a need for a central authority (often federal) to impose big energy facilities and their perceived risks on people who want neither;
- conflicts between central authority (often federal) and local autonomy in all energy matters;
- concentration of political power, enabling urban people to obtain the benefits of the energy while inequitably allocating the associated social costs to politically weaker rural minorities, as has already happened in Wyoming, Appalachia, the Brooks Range in Alaska, and Navajo country;
- a tendency to make patterns of energy end-use conform to the needs of the source of supply rather than to people's needs;
- encouragement of horizontally-integrated monopolies;
- isolation and alienation of energy users from the unaccountable elite who supply, price, and regulate the energy;
- commitment by the political authority to support the continued uses of the energy system regardless of any inherent faults, and hence to suppress dissent—or use social engineering to bypass dissent—even in the case of major accidents or technical failures;
- development of strong central bureaucracies and technical establishments that favor the technologies they develop and come to dominate decisions about their use.

Members of the New York State Labor Action Coalition, a group of labor union locals working for municipal takeover of investor owned utilities, have pointed out that increasing the size and concentration of energy systems diminishes the chances of communities *ever* obtaining control of their own energy production and distribution. In addition, centralization and automation of energy systems lead to the closing of existing smaller facilities, and enable industry management to keep their plants running with the use of a handful of supervisory personnel. The consequence will be smaller, and weaker, labor unions.

Source: The Unfinished Agenda, a Task Force Report Sponsored by the Rockefeller Brothers Fund, Crowell Company: N.Y., 1977.

per dollar, consume less energy, and create less environmental and public health havoc. Consumers will be paying increasing prices for unneeded, inefficient and unreliable energy systems which will be unable to provide a return on the money invested in them. Consumers will also be paying higher taxes to protect their health and bail out failed energy systems. (This is happening now: Nuclear Fuel Services' fuel reprocessing plant and a Con Ed nuclear reactor in New York State have already been dumped into the laps of the people of New York.) Higher interest rates will also result because of the money shortage caused by the diversion of so much capital to the energy arena. (Some projections show this shortage may total $915 billion through 1985.[38])

Surely, there is a better path to prosperity and jobs.

VII. Energy Efficiency

Energy production is not a goal in and of itself. Energy should be utilized to serve people, to provide the freedom for all people to have richer, easier, healthier lives. That a nation uses vast amounts of energy does not reveal to what extent the energy is actually being put to wise, effective use by its people.

The best approach to energy sufficiency, economic prosperity and jobs is that which combines increasing energy efficiencies with a variety of diverse and safe energy-supplying technologies. Each energy-producing technology should be used to do what it does best, and should be matched in scale and energy quality to the way in which its energy will be used. And the more the fuels for these new energy systems are renewable, the better.

This approach is not "anti-technology," as sometimes is alleged by the large energy interests. In fact, technological innovation will be a key to achieving success with this approach . . . but the technologies involved need to be ones which can be controlled by the American people, not ones so elaborate and complex that people have to be kept far away from them or from decisions concerning them.

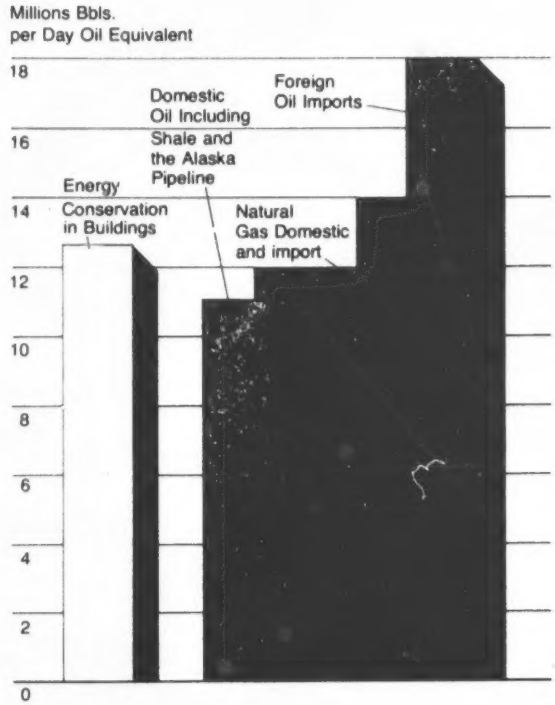
And this is not a "no growth" approach, or one which advocates a return to drudge labor. To the energy industry, "growth" has always meant growth in energy production in order to satisfy its own needs, no matter the consequences for the rest of society. But to others, "growth" means a national policy of full employment, improved standards of living, improved job safety and public health, expanded opportunities for leisure activities and the development of rewarding relationships with other people.

How can increasing energy efficiencies (that is, conservation of energy) make a significant contribution to such goals? Here is a brief list of just some of the benefits which result from energy efficiencies:

- To the University of California's John Holdren, the essence of conservation is "extracting more well-being from each gallon of fuel and each kilowatt of electricity."[40]
- A unit of energy saved is cheaper—in dollar, energy, public illness and environmental costs—than a unit of energy produced. The Bonneville Power Administration has concluded that saving energy by conservation costs *one-sixth* of what it costs to deliver an equivalent amount of energy from new thermal power plants.[41]
- "Saving energy," said former Federal Energy Administration Director Frank Zarb, "is synonymous with saving dollars and can, in fact, be one of the least expensive energy supplies this nation has."[42]
- Denis Hayes has calculated that for the next quarter century, the United States could meet all its new energy needs "simply by improving the efficiency of existing use."[43]
- The American Institute of Architects (AIA) has calculated that by 1990, 12.5 million barrels of petroleum per day (equal to one-third the current national energy use) could be saved just by employing energy-efficient systems in old and new buildings. The following chart prepared by the AIA shows that conservation alone in buildings offers an energy supply which by 1990 would be larger than the contribution of any one of the following: domestic oil, conversion of shale to oil, Alaskan North Slope oil, domestic and imported natural gas, and an overly-optimistic prediction of nuclear energy output.

CHART I[44]

AIA ESTIMATES OF THE RATE OF ENERGY SAVINGS IN BUILDINGS COMPARED WITH THE CAPACITY OF PRODUCTION FROM VARIOUS OPTIONS AS FORECASTED BY THE U.S. GOVERNMENT



In order to supply the energy equivalent of 12.5 million barrels of oil per day in 1990 by traditional centralized energy systems, a capital investment of $415 billion would be required. The customer would pay between $892 billion and $1.4 trillion for this unneeded energy. But investing money in energy efficient buildings, says the AIA, would produce both energy and dollar savings.

- The Bonneville Power Administration has summarized a number of energy-savings estimates calculated by its consultants and a variety of other analysts:

TABLE III[46]

COMPARISON OF ESTIMATED CONSERVATION SAVINGS

BPA Study (1995 savings)	*Other Studies*	
Residential Sector		
14-48%	24.8%	Energy 1990 (City of Seattle, 1976)
	38-49%	U. of Calif. (Goldstein, 1975)
	30-40%	Oak Ridge National Lab. (1973)
	11.3-42.7%	Arthur D. Little, Inc. (1976)
Commercial Sector		
22-44%	30%	Energy 1990 (City of Seattle, 1976)
	30-80%	American Institute of Architects (Stein, 1974)
	30-50%	U.S. General Services Administration (1973)
	59.6%	Arthur D. Little, Inc. (1976)
Industrial Sector		
5-10%	31.7%	Energy 1990 (City of Seattle, 1976)
	24%	West German Industries (Stanford Research Institute, 1975)
	15-30%	National Bureau of Standards (1974)
	30%	Federal Energy Administration (1974)

• General Electric's Evandale, Ohio, jet engine plant has cut its energy use by 45.1% over the last five years, "with nothing more sophisticated than a chicken coop timer." G.E.'s program has saved the company $8.6 million, at an investment of $400,000.[46]

• 1976 cars already average 27% better mileage than 1974 cars. 1977 cars will average 6% better mileage than the 1976 models.[47]

• An energy study commissioned by the City of Seattle influenced that city not to buy into Oregon's nuclear power plants. The study convinced city officials and Seattle citizens that with appropriate energy efficiency measures, **no new electricity generating capacity would be required for Seattle through 1990.** And, the cost per kilowatt hour of electricity would be 1.3¢ *cheaper* without building new energy facilities.[48]

• A Dow-Midland study indicated that by using waste industrial steam to generate electricity—as is done in Sweden and West Germany—energy savings equivalent to 680,000 barrels a day of oil could be saved by 1980. By 1985, this "co-generation," as it is called, could replace the equivalent of 50 large nuclear reactors.[49] The California Energy Commission has determined that the potential for co-generation in that state alone could be as much as 140 billion kilowatt hours per year, the equivalent of the total amount of electricity consumed in California in 1975.[50]

• Energy conservation retrofits have led to a 60% decrease in steam use, and a 30% decrease in electrical consumption, at the Hermann Building of the Massachusetts Institute of Technology.[51]

• The Director of the Massachusetts Energy Policy Office has concluded:

> Energy conservation is not synonymous with deprivation. In fact, just the opposite is true. Saving energy means saving money. For a household, this means more cash for other activities; for a business, this savings means higher profit. For the state in general, this means more jobs, and more income for our citizens.[52]

FOR GOODNESS'

If expansion of large, complex energy systems is so wasteful, causes pollution and disease, gobbles up investment dollars, threatens the democratic process, displaces existing jobs and chokes out large numbers of new jobs, why have utilities and energy industries been so determined to expand, expand, expand?

For regulated utilities, there is a clear, direct relationship between energy growth and profits—*their profits.* A utility's rate of return on investment is set by law at a fixed percentage. The more they invest, the more profits they reap. To attract more investors who will put up the money for more facilities which will return more profits in order to attract more investors, utilities seek to invest in more facilities which will attract more investors and return more profits.

If consumers use decreasing amounts of energy, utilities have a hard time justifying investment in more energy-producing facilities. Less utility money is available for reinvestment, and utilities begin to experience difficulty attracting money from the financial community. Because energy use has decreased (or in some places has increased at a lower rate) since the Arab oil embargo, many utilities have lost large amounts of revenues, and have ended up with unneeded facilities which were planned a decade ago. They have had to seek huge rate increases to pay construction and operation costs of their expensive overbuilding. Thus do consumers rightly complain that it does not make much difference whether or not they turn their thermostats down: they may use less energy, but their bills keep going up anyway.

It is just not in the interests of the utilities to promote energy efficiency very seriously.

Utilities pay some lip service to conservation—especially when there are shortages of fuel or they are having particular problems delivering the energy they are required to deliver. But they do not want to encourage *too much* conservation. A recent Mobil advertisement, for example, had some nice words about conservation, but it strongly stressed the need not to "trade-off" conservation for jobs or GNP growth, and the need to preserve consumers' "freedom of choice" to use energy as they see fit.

Thus, in order to raise their rates to expand and increase profits to expand and raise rates, it has been in the interest of the utilities to have people believe that energy growth

• States are beginning to respond to the Energy Policy and Conservation Act (1975) which provides FEA money to a state which can cut back at least 5% of its energy use projections, beginning in 1980. Colorado plans to save 52.8 trillion BTUs in 1980. Governor Lamm, in his state's energy conservation plan, sums up the rationale:

> Conservation is the only way in the next few years we can bring some manner of economic relief to the millions of our citizens who cannot afford the vastly increased cost of energy. Conservation is the least expensive and most cost-effective way to expand our energy "supply" . . . A conservation program will reduce the impact [of energy production] on the environment . . .

SAKES WHY?

leads to employment growth and economic prosperity; to persuade large industries to use energy extravagantly by charging the lowest rates to the largest users; to threaten that without nuclear and other exotic energy systems Americans would soon freeze and starve in the dark; and to oppose environmental and public health measures, which interfere with their visions of unlimited expansion without regulation. In addition, utilities have recently become interested in the plight of the poor and disadvantaged: utilities take great advertising pride in having brought them to the threshold of the good life, and are now declaring it is for the sake of these people that more and more giant, dangerous energy facilities should be built.

Some of the nation's largest manufacturers build the equipment used by the utilities. They also build and sell the appliances that people buy, and the machines that industries buy, all of which consume large amounts of energy. Many of the corporations which control energy resources (coal, oil, gas, uranium) are also in the business of finding, obtaining, transforming and delivering these resources in usable form. The profits of these companies increase as the utilities expand their ability to supply energy. Clearly, then, it is in the interest of the energy-production companies and the energy-equipment manufacturers to throw in their lot with the utilities.

The utility industry, with the full support of energy industries and the government (which has provided research, development and demonstration money, along with favorable subsidies and tax incentives), has been very successful at expanding without much caring about the undesirable societal, economic and human consequences of their efforts. This confirms what John Maynard Keynes noted earlier in the century.

> There is no evidence from experience that the investment policy which is socially advantageous coincides with that which is most profitable.

Sources: Ernst & Ernst, *Energy-Economy Relationships*, June, 1976; Ernst & Ernst, *Incentives For Electric Utilities to Overforecast*, July, 1976; Daly, Herman, *Towards A Steady State Economy; Washington Post*, March 12, 1977 (the Mobil advertisement).

> An essential part of any serious program to promote energy efficiency must be a systematic and credible effort to convince the public of the enormous benefits that are possible . . . The economic and energy savings can be calculated, and they are attractive.[33]

• Again, FEA's Zarb:

> Contrary to myth, conservation is vital to our efforts to sustain our high standard of living and rekindle economic growth. Moreover, several recent analyses have shown that reducing the inefficient use of energy would not result in an employment penalty.[34]

• And even Americans for Energy Independence, an energy industry-oriented group which seeks the expansion of large-scale, centralized energy systems, has noted that

> . . . energy conservation and economic well-being are compatible . . . Even the most superficial and immediate measures to cut waste would revive our environment.[35]

• Conservation of energy will supply goods and services at lower total cost than could be supplied by new energy development. The money which might have been spent on energy production would be available to pay for labor, designs and materials for energy efficiency techniques. There will also be money left over for other investments. The result will be more goods, more services, more employment—both direct and indirect, as the Bonneville Power Administration has pointed out. And, as Denis Hayes has observed,

> To the extent that a consumer conserves fuel and spends the money on anything else, he will provide more employment as well as use less energy.[36]

• Energy conservation offers considerable manufacturing flexibility. Most energy conservation technologies will be implemented on a small scale, and on regional bases. Industry will therefore be able to develop improved technologies through competitive trials, then cut production costs by means of mass production. A "balanced" and independent regional economy based on improved energy efficiencies could provide more jobs, with more job security, than an economy dependent upon energy sent in from far away. The reason for this is that the manufacturing base would be varied, would require less energy, and be less sensitive to changes in economic, political and meteorological conditions in other parts of the country.

In addition, raising investment capital would be less of a problem because energy efficiency programs are cheaper than energy-production projects. Their short planning and completion time would mean that cash flow would be speeded up: money for energy efficiency investments could be used several times rather than be tied up in a long-term energy-production project.

And with regard to jobs created by energy conservation, there are significant positive benefits as well.

VIII. Energy Efficiency and Jobs

• A Bonneville Power Administration Study has found that

> High impact conservation programs create more jobs than would be created by building new power plants to generate an equivalent amount of energy.[37]

Amory Lovins has testified to the Senate Select Committee on Small Business that conservation programs which include shifts of investments from energy wasting to social programs create from tens of thousands to nearly a million net jobs per quadrillion BTUs of energy saved.[38]

• A preliminary analysis for the FEA[39] provides specific breakdowns of some energy conservation techniques, costs and resulting employment. This report examined the prospects of limited energy efficiency increases in 34,372 private homes. The technical work called for was simply the installation of ceiling insulation and automatic thermostats, and the retrofit or replacement of furnaces.

The analysis concluded:

> By 1985, natural gas supply would be increased because of the saving of 1,212 billion cubic feet. This is the equivalent of the gas to be obtained from the major discovery at the Alaskan North Slope. It is also about the equivalent of the output of 39 one-thousand megawatt electric thermal power plants. Consumers in these 34,372 homes would save $1.7-$2.3 billion in heating costs.
>
> The work would cost $7-$10 billion, compared with $17-$20 billion for 39 large fossil fuel power plants; 487,000 jobs over 7 years would be created: 122,000 in manufacturing, 366,000 in local installation.

The report also stressed that employment associated with energy conservation techniques is local, low- to moderately-skilled, and concentrated in or near urbanized areas which are experiencing the most acute unemployment problems. In contrast, centralized, expensive energy production complexes usually have to bring in highly-skilled labor from outside the construction area. (These transients create a large amount of disruption: temporary housing and many services must be supplied to meet the problems temporary workers create. In many of the energy "boom towns" of the Western United States, crime, alcoholism, family break-ups are well above average. Serving the needs of transient labor ends up being a drain on the local economies the transients were supposed to be stimulating.)

- The State of Colorado has estimated that 17 million private homes in the nation need ceiling insulation; 20 million need clock thermostats; 20 million need caulking and weatherizing; 10 million need storm windows. In addition, millions of multiple-unit dwellings, apartment houses, commercial and industrial buildings are inadequately insulated and weatherized. If 487,000 jobs are generated by only three simple conservation procedures in a small fraction of the buildings which need work, the potential obviously exists for millions of jobs. Employment for energy specialists, construction of more energy efficient equipment, jobs for architects and engineers will be increased, along with jobs in the fields of insulation, heat pumps, electronic controls and systems analyses, communications and transportation.
- The Senate Commerce Committee Staff has estimated that $1.6 billion in interest subsidies and loan guarantees for conservation retrofits would generate 400,000 jobs.[80]
- The American Institute of Architects' conservation program for new and existing buildings would create half a million to more than a million direct jobs per year through 1990.[81]
- The conservation retrofits on MIT's relatively small—94,000 square feet—Hermann Building, provided 800 person hours for members of the Sheet Metal Workers' International Association.[82]
- A proposal sent to President Carter by the Senate Commerce Subcommittee Staff describes how a $1.65 billion investment in energy conservation, using public service workers, would create a total of 100,470 jobs: 9,600 at $15,000 per year; 74,600 at $10,000; and 16,279 jobs in manufacturing. The staff calculated that each $40,000 investment in materials would create one job in the materials manufacturing industry. The program would focus on the retrofitting of schools, colleges, hospitals, federal buildings, the weatherizing and installation of solar water heaters in HUD-owned single family houses, and the construction of bicycle paths.[83]
- A study by Skip Laitner of Critical Mass computed that manufacturing high efficiency appliances requires the employment of more people than does the manufacturing of inefficient appliances.[84] When buying more efficient items, a consumer is investing in extra labor and materials, and in a more carefully-constructed, longer-lasting product. The purchaser would save money on reduced electricity bills, which would cover the higher initial cost of the appliance. Thereafter, on-going savings in energy can be spent on consumer goods, which as described above, create more jobs than spending on energy generation.
- According to *Americans For Energy Independence*,

> experts have suggested that reducing oil imports by 2 million barrels a day would generate 500,000 to 800,000 new jobs in the U.S.[85]

- And an annual energy savings of 144 trillion BTUs achieved by the nation's switching to refillable-container systems would result in a net job increase of 117,000. Total labor income would increase $936 million, according to a recent FEA study.[86]

In sum, increasing energy efficiencies will supply the nation with a substantial source of energy. The savings of money and the reduction of energy waste will generate a broad range of economic and environmental benefits throughout the country, and create large numbers of safe, socially-useful jobs.

For **new energy sources**, the nation needs to utilize the unlimited energy which is available from the sun.

IX. Solar Energy

The solar energy reaching the United States in twelve hours is equal to the nation's yearly energy consumption.

Various technologies exist which can utilize this abundant and safe source of energy: solar plate collectors for heating and cooling of buildings, and for heating water; photovoltaic cells for converting sunlight directly into electricity; wind energy systems for producing electricity, pumping fluids or compressing air; biomass conversion for creating fuels from organic matter.

For all solar energy systems, the fuel is renewable. For all except biomass conversion, the fuel is free. If energy quality is matched to its ultimate use, each of these systems except photovoltaic conversion has lower capital requirements per unit of energy delivered to the user than does nuclear fission and production of synthetic fuels from coal. All these solar technologies readily lend themselves to small, decentralized installations.

According to John Quarles, former Deputy Director of the Environmental Protection Agency, some solar energy techniques can be commercialized sooner than can the nuclear breeder reactor, shale or coal conversion systems, or nuclear fusion reactors.[87]

Senator Charles Percy (R-Ill.) recently stated at a solar energy conference he helped organize:

> Solar energy is not an exotic dream of the future. Rather, it is workable today.[88]

The Grumman Corporation "Sunstream" division has advertised: "An answer to OPEC comes up every morning!" With Sunstream's domestic hot water heater,

> you can now capture the sun's energy to heat hot water for your household needs . . . efficiently, quietly and cleanly.[89]

An ERDA report, *A Preliminary Social and Environmental Assessment of the ERDA Solar Energy Program*, has pointed out that solar energy technologies are readily adaptable **today** for broad scale commercial use.[70]

According to the Federal Energy Administration,

> In general, the application of solar energy techniques does not require establishment of scientific feasibilities.[71]

George Szego, president of Intertechnology Corporation, has stated that savings of five billion barrels of oil could be achieved within 10-15 years if a crash program of solar energy commercialization were begun now.[72]

Edward J. Carlough, General President of the Sheet Metal Workers' International Association, recently noted that almost 25% of all energy used in this country is consumed in heating, ventilating and air-conditioning, and related systems. He went on to say:

> At a relatively low cost, we could make a huge dent in the nation's energy consumption by modifying those systems to use solar energy where it is feasible. The national value of a concerted effort in solar energy and energy conservation would be measured in millions of barrels of oil—resulting in more favorable balances of payments, less inflation, more jobs and energy independence.[73]

The Sheet Metal and Air Conditioning Contractors' Association has affirmed in testimony before Congress:

> We have the skills, shop facilities, manufacturing capability and expertise to embrace this industry now. New tools and processes are not required.[74]

A report prepared in 1952 by the Paley Commission for President Truman concluded that solar energy could play a greater role in energy production than could nuclear fission. The Commission projected that if an aggressive effort were made, 13 million homes and commercial buildings could be heated by solar energy by 1975.[75] And an Atomic Energy Commission study concluded in 1974 that by the year 2000, solar energy could provide 30% of the country's energy needs.[76]

Although efforts to enable these predictions to come true were not made, there is nonetheless a significant amount of solar activity in this country today. The Solaron Corporation of Denver had a half-million dollar order backlog earlier this year, and was installing hot water systems in 60 buildings in 12 states.[77] The Piper Hydro Company installed 1000 dwelling hot water units in 1976, and "hasn't even scratched the surface" of demand.[78] The Federal Energy Administration has announced that commercial production of solar collectors increased 400% in 1975 over 1974. A total of 142 firms are now manufacturing collectors, and the industry seems to be in a trend of quadrupling production annually.[79] Solar energy busi-

Beware Full Employment

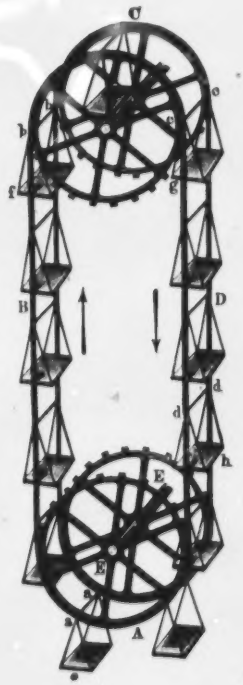
by Robert Lekachman

". . . Unemployment calms the unions and moderates their wage demands. Business periodicals have been noting with unconcealed gratification that last year's contract settlements between major unions and large corporations were considerably less expensive for employers than those of 1975, even though union members were steadily losing ground to inflation. When people are scared about losing their jobs, they work harder and gripe less. In more dignified language, absenteeism declines and productivity ascends.

"Better still, factory and office workers, alert to potential layoffs and plant shutdowns, are unlikely to nag unions and employers to make work more interesting, and less menacing to health and personal safety. It cannot be mere coincidence that in Sweden, where job enrichment and plant democracy have had their greatest success, unemployment is practically zero and astute management of their economy protected Swedes even from the worldwide economic crisis of 1973-1975. The new government, elected on the fortuitous issue of nuclear safety, has promised to extend even further the social benefits for which Sweden has become celebrated. American employers preserve themselves from Swedish experiments in good part by keeping the industrial reserve plentifully manned.

"Nor is this quite the end of the tale. The hunger of communities and regions for jobs and tax revenues has allowed large corporations to extort an endless assortment of valuable concessions from local and state governments, either as blackmail to keep existing installations or bribes to lure new ones. Few major corporations pay their fair share of property taxes. Propaganda by oil, steel, chemical, and paper industries has noticeably slowed the pace of regulation to protect the environment.

"By contrast, full employment on a sustained and assured basis (the system can stand a spell of full employment as long as all parties understand that it is temporary) presents an embarrassment to the movers and shakers of American plutocracy. To begin with, full employment is the most efficient agency of equitable income redistribution which is at all feasible in the United States. Full employment sucks into the labor force men and women who now struggle on welfare, food stamps, social security, and unemployment compensation. It pushes up the wages of low-paid people whose position is scarcely less precarious than that of the unemployed. It is an especial boon to blacks, Hispanics, teenagers, and women — last hired and first fired in expansion and recession alike. A long spell of full employment would substantially narrow existing wide differentials between earnings of these groups and those of white males. In a time of layoff and business contraction, affirmative action is a mockery, but when there is full employment the cry for justice is heard more sympathetically by members of a majority whose own security is not threatened."



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nessman Jerry Plunket has estimated that 100,000 shops, manufacturers and firms are capable *now* of producing reliable solar energy equipment.[80]

Solar energy studies—even those which suggest that a significant contribution by solar technologies to the nation's energy needs is a long way off—constantly stress how much energy could be obtained from the sun, and how safely. FEA's former director Zarb:

> Solar energy appears to be the safest and most environmentally sound of all energy . . . It is inexhaustible, and it can't be embargoed.[81]

A study by the Oregon Energy Council found:

> A transition to a solar energy economy is desirable and realizable. It involves neither privation nor social deprivation. Life-style changes would be minimal. The rewards would be enormous. Our children would have a totally indigenous, permanent, safe energy system which could be relied on by countless generations for the future.[82]

The ERDA *Social and Environmental Assessment* of solar energy concluded:

> Solar energy is the one source of energy for which there are no fundamental obstacles, no insurmountable barriers, no serious environmental problems, no organized public interest opposition.[83]

The Solar Task Force of the Project Independence Report made clear that:

> A major shift to the utilization of solar energy by the year 2000 and beyond will reduce the effects of rapidly-growing energy consumption on our global climate through a reduction in heat waste rejection at the generating site. Solar energy is the only energy source which presently holds this promise.[84]

And even according to the Exxon Corporation, a multinational company heavily invested in oil, coal and uranium, and which is fond of predicting that solar energy technologies will not be particularly useful until the next century, the sun is

> a source of energy that doesn't in any way pollute the air or water, can't be used up, and is found right in our own backyard.[85]

Here is a brief look at some of the methods solar energy can be utilized to meet the nation's needs:

SOLAR HEATING AND COOLING

Solar heating and cooling involves the use of collectors on site which absorb the sun's energy. This method of heating buildings and water is not new. In fact, it has been utilized in this and other countries for many years.

According to former Congressman Paul Cronin, solar heating and cooling systems

> can have an immediate effect on our overall energy budget . . . Most of the U.S. patents on solar [heating and cooling] were issued in the 1920's. Florida received the majority of its hot water from solar energy until World War II . . . If the government decided to provide a solar hot water heater to everyone in the U.S., which could be done in 3 years, it could save over 1.2 million barrels of oil per day, and create . . . jobs that would pay taxable incomes.[86]

Again, Sheet Metal Workers' Association President Carlough:

> Solar heating/cooling systems using air are no longer a novelty. This is a technology capable of producing energy and jobs.[87]

The Technical Development Corporation (TDC) of Providence, Rhode Island, designed the solar heating system for the swimming pool at the United Auto Workers' (UAW) Family Education Center in Northern Michigan. The installation costs for the UAW system will be paid back in 6½ years. Thereafter, $3000 per year will be saved by the Auto Workers in decreased bills for conventional fuels. TDC studies have confirmed that the use of solar heating for swimming pools, laundries and industries which use large amounts of water, will generate similar rapid returns.[88]

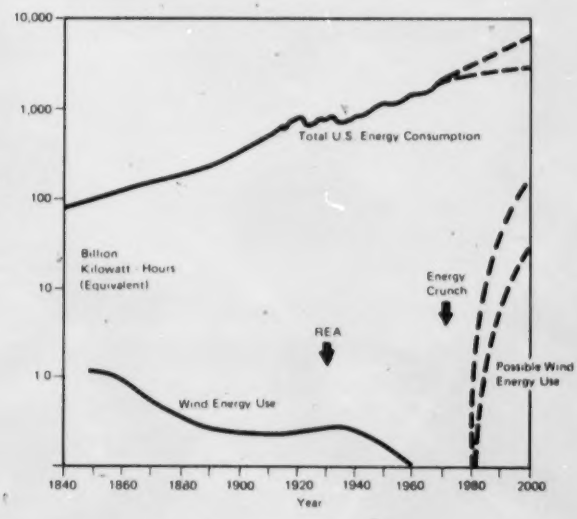
The Energy, Research and Development Administration has recently announced that solar residential hot water and space heating are economically competitive *today* with electric systems in 12 geographically-dispersed American cities. (Among these cities are Boston, New York, Madison and Washington, D.C.) These kinds of solar units, stated ERDA, could become economically competitive with "most fuel alternatives" by 1980.[89]

WIND ENERGY

Research and development in wind power have been virtually non-existent in this country for about 30 years. But since the mid-19th Century, more than 6 million small windmills have been used to pump water, compress air and generate electricity. Over 150,000 are still in operation. But significant use of wind power was phased out in the 1930's when the Rural Electrification Administration (REA) introduced centralized electric power, as shown in the chart below:

CHART II[90]

COMPARISON OF WIND ENERGY AND TOTAL U.S. ENERGY CONSUMPTION



According to a 1972 National Science Foundation-National Aeronautics and Space Administration report, wind energy

systems could be installed in a very short period of time—less than two years. Companies such as Boeing, Kaman, General Electric and Lockheed, along with a growing number of smaller firms, have indicated they are willing and able to provide wind energy systems this rapidly.

Wind power expert Lorin Johnson has testified:

> Wind energy systems not only give a utility [company] more flexibility than do conventional thermal power plants due to shorter lead times, they also allow new technological innovations to be easily and rapidly incorporated as they occur . . . The failure of one wind energy system will not force the shutdown of another . . . The failure of one wind energy system in a large array is . . . not a major thousand megawatt catastrophe.[91]

The Project Independence "accelerated development" scenario, which many experts consider to be quite conservative, estimates that 23% of the nation's electricity could be generated by wind power by the year 1990.[92] And a National Science Foundation-Mitre Corporation study found that electricity produced by wind power would be competitive with conventional diesel fuel electrical generating plants which use oil priced at $10-$11 per barrel, a price which exists today.

The Technology Development Corporation has calculated that wind generation of electricity is currently economically competitive with other systems on the seacoast of the Northeastern states. As complementary energy systems, they are "immediately viable." The wind machine this company built for the United Auto Workers will shortly be producing power in cooperation with a Northern Michigan utility.[93]

The New York State Energy, Research and Development Authority has announced the installation of a demonstration wind generator on a working dairy farm in Northern New York. Said the Authority's Chairman: "Cost-effective use of new [wind] energy technologies is available today."[94]

BIOMASS CONVERSION

Biomass conversion involves the changing of organic matter into useful fuels, such as gas or oil, or directly into heat.

The various biomass techniques include utilizing urban and industrial wastes, agricultural and forest residues, along with farming on land or in the ocean.

According to Senator Peter Domenici (R-New Mexico), the advantages of obtaining energy from biomass conversion are many: sources are forever renewable; the environmental impacts are minimal; marginally useful lands and waters can be put to use; a range of assorted bioconversion products can be developed differing in kind and quality which can be matched to physical and economic needs.[95]

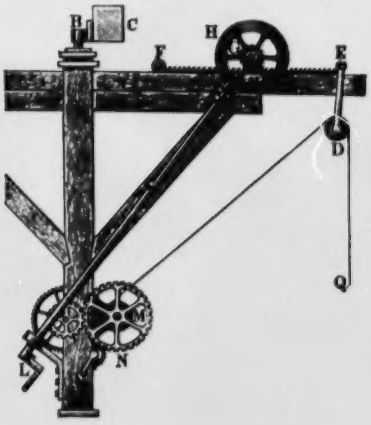
About 80% of the total annual municipal waste is combustible, said Domenici, and could be used to generate energy equivalent to more than half the 1970 oil imports from the Middle East. Some American cities are burning refuse to generate energy, and over 100 cities are actively studying the process and looking to rapid installation of a variety of systems.

Harvest and bioconversion of ocean kelp into methane gas would generate 23 trillion cubic feet of gas per year. (This is equal to the current national annual gas demand.) Land plantations could generate 8-11 trillion cubic feet of gas per year. Some gas companies are presently experimenting with ocean- and land-cultivated kelp production.

China has built one-half million methane gas digesters since 1970. India is constructing 100,000 of them.

Bioconversion techniques are especially conducive to dispersed, flexible, low-capital enterprises which create many jobs. The chairman of the American Gas Association has said:

> From a social or political standpoint, it appears desirable that gas be generated on a local basis from such sources as urban refuse, industrial wastes, sewage sludge and miscellaneous wastes.[96]



PHOTOVOLTAIC CONVERSION

Solar photovoltaic cells convert sunlight directly into electricity at the place where the electricity is to be used. They are already cost-competitive with other energy systems in remote areas. Their efficiency has been going up, and their price going down, despite limited federal and industrial interest. In the early 1960's, energy from photovoltaics cost about $200 per peak watt. By the early 1970's, the cost had dropped to $100. By 1973, it was $30; and in 1975, $17. Recently, the energy from photovoltaic cells has been available for $10 per peak watt.

Since photovoltaic cells convert solar energy to electricity on site, there is no need for long-distance transmission lines, and therefore no energy loss along these lines. Solar cells, like wind systems, can be installed in small units, and added on to when needed. The use of photovoltaic cells allows energy planners to avoid having to predict years in advance what the specific energy demand of a region will be.

A 1975 National Science Foundation report found that by the year 2000, photovoltaic electricity could supply 9% of the nation's needs—a figure which many today consider understated.

The evidence is overwhelming that solar energy technologies are available today, and that they offer many technical, environmental and financial advantages over other energy systems.

They also provide significant employment benefits.

X. Solar Energy and Jobs

Frank Zarb has said:

> A strong solar industry means more jobs for Americans, who will be needed to design, manufacture and install and maintain solar equipment.[97]

The Sheet Metal Workers' President Carlough:

> . . . even figured conservatively, energy-saving modification work and an expanded use of solar energy could put all unemployed sheet metal workers back to work.[98]

The Massachusetts Energy Policy Office recently concluded that if by 1985 one-half of all buildings in that state were to use solar energy for hot water production, 32,000 jobs would be created. In addition, 600 million gallons of oil would be saved per year, and $480 million retained for spending within Massachusetts. The report stated:

> The potential for solar energy seems virtually unlimited. With widespread adoption of solar power, Massachusetts citizens could cut their collective fuel bills by $120 million annually by 1985. Furthermore, solar energy has vast potential for new job opportunities, especially in the plumbing, construction and research and development areas . . . It's safe to say that by 1995 more jobs could be available from solar power (directly and indirectly) than from offshore oil and new nuclear construction combined.[99]

Frank Mills, of the Sheet Metal and Air Conditioning Contractor's Association, has reported that retrofitting just 3 million private homes to 60% reliance apiece on solar energy for heating and cooling would lead to 12.2 million hours per year of work for 10 years. And putting solar heat in 2.3 million new homes, at 60% reliance, would create another 12.2 million hours per year of work for ten years . . . for sheet metal fabricators, sheet metal installers, asbestos workers, carpenters, plumbers and pipefitters. Increasing the number of installations to half of all private homes would mean about 5 times the number of hours of work. In addition, thousands of jobs would be created in retrofitting and new installations of solar systems in commercial buildings, apartment houses and government buildings.[100]

A 1975 study for the Sheet Metal Workers' International Association found that heating and cooling could provide a $2 billion market annually by 1990. Installation labor would cost half a billion dollars, of which $240 to $300 million per year is expected to be paid to sheet metal workers (about 15,000 jobs at $20,000 per year).[101]

The Laborer, a journal of the Laborer's International Union (AFL-CIO), found that jobs for its members in the solar energy field "could well mount into the hundreds of thousands." The union has begun a course in San Diego to train laborers in the installation and maintenance of solar and wind systems. Union President Angelo Fosco has said:

> Experts estimate the annual market for installing solar systems and converting existing structures to solar systems has a potential of $77 billion alone . . . . not including maintenance . . . . That translates into a goodly number of jobs for construction workers in our jurisdiction.[102]

The President of the International Association of Machinists and Aerospace Workers (IAM), Floyd Smith, told delegates at an IAM-United Auto Workers legislative conference in January, 1975:

> If, for example, the government launched a program tomorrow morning to equip each home in America with a rooftop solar water heater, scores of factories would be retooled and reopened. Thousands of jobs would be created for unemployed machinists and auto workers.[103]

The IAM Grand Lodge Convention in Florida last year passed the following resolution:

> An all-out federally-sponsored program to convert home water and space heating to solar would not only decrease America's dependence on foreign oil, but create millions of needed jobs for construction workers, machinists, metal workers and other industrial workers.[104]

The IAM newspaper, *The Machinist*, quoted one solar advocate as saying: "Using local solar energy makes much more sense than carting oil halfway around the world." And *Machinist* associate editor Dean Ruth wrote:

> Millions of Americans are jobless. Other millions face the threat of unemployment. Solar energy, as a new industry, can provide a vast amount of work to help get America moving forward again.[105]

An economist with the International Woodworkers of America (AFL-CIO/CLC) has written:

> Employment opportunities exist with the development and construction of alternate energy sources such as solar, tidal, geothermal and wind . . . . sound conservation methods and the development of alternate [to nuclear] sources will not adversely affect job opportunities in the economy. The job impact would, in fact, be positive.[106]

An article in *Worklife*, a magazine published by the U.S. Department of Labor,[107] was titled "Solar Energy: Potential

GNP

The selection of Gross National Product (GNP) as a main criterion for evaluating the nation's economic health has served to mislead the public on energy and employment issues.

GNP is the market value of all goods and services produced in the economy over the course of a year. As far as GNP is concerned, **everything that costs money** is considered a benefit. GNP includes expenditures for desirable items—such as for energy, housing, education, food, etc., but without taking into account whether they are made available efficiently or safely. GNP also includes costs of items not generally considered to be beneficial to the nation: disease treatment, pollution clean-up, weapons production and sales, wars, as well as unemployment insurance, workman's compensation, welfare payments, etc.

Some analysts believe that the only part of the GNP which is actually increasing these days is that part created by the costs of pollution, environmental degradation and human suffering caused by wasteful, inefficient and dangerous methods of production (especially of energy).

A recent Harris poll has indicated that a growing number of people believe the quality of life has generally deteriorated over the past decade. But the GNP has been increasing, despite some temporary decreases in "growth" rates during the '74-'75 recession. Thus, although individuals believe the quality of life has gotten worse, according to the GNP, the economy has gotten bigger and better.

For the United States to be striving for ever larger and larger GNP, to be basing energy, employment and other strategies on a deceptive criterion which conceals what is actually taking place in terms of unemployment, energy waste, work-related illness and public morbidity, does not appear to be the height of wisdom.

Powerhouse For Jobs." It listed some of the skilled workers needed to build and maintain solar units: carpenters, cement masons, electricians, plumbers, sheet metal workers, air conditioning, heating and refrigeration technicians, glaziers, crane operators. New jobs, the article says, will have to be created and ground broken in solar engineering, architecture, law, real estate and appraisal, sales, zoning, assessment and consumer protection.

The FEA Project Independence Task Force found that 3 to 4 million person-years of direct jobs would be needed in solar energy development and operation by 2000.[108] This figure is probably an underestimation, since FEA's 1974 "accelerated" rate of solar development is thought by analysts today to be too conservative. Among other things, it is based on oil selling at $11 per barrel when it is now selling for as high as $16—and going up; also, some of the solar technologies were considered for only certain parts of the country, i.e., the Southwest, which many believe an unnecessary limitation. Dr. Jerold Noel, for example, a physicist at Mobil-Tyco solar labs, has stated:

> The roof of an average house around Philadelphia could produce enough energy to supply the needs of a home, with enough energy left over, say, to charge an electric car.[109]

The jobs, according to the Federal Energy Administration, would be for the skilled tradespeople listed in *Worklife*, as well as for welders, bricklayers, concrete finishers, painters, iron and insulation workers, electrical and mechanical engineers, technicians, scientists and surveyors.

Fred Dubin, president of an engineering, planning and management firm which has conducted comprehensive energy analyses for many parts of the country, found that two billion dollars invested in energy conservation and solar power provides four times as many jobs as if it were invested in nuclear reactors (64,000 to 15,000).[110] Skip Laitner has shown that about 2½ more jobs are required for solar-developed energy than for the same amount of energy produced by nuclear fission.[111]

The job mix for the various technologies is different. Nuclear energy utilizes fewer tradespeople per professional scientist or technician than does solar energy: for nuclear, the ratio is about 2 to 1; for solar, it is 9 to 1.[112] In addition, a broader array of skills are necessary for building and maintaining solar systems than for building and maintaining nuclear plants. And, as an ERDA report stated:

> Solar systems provide much more room for small business and geographically dispersed businesses and workers than do some of the more complex systems.[113]

A report to the New York State Legislative Commission on Energy Systems calculated that the operation and maintenance of large wind systems require 2-4 times the labor force on a continuous basis than do nuclear fission or coal-fired systems. And the building of wind systems, said the report, would provide employment in generator and electrical component manufacture; sheet metal and structural steel fabrication; cement and wire production. The combined continuous labor requirements for construction and operation of wind systems without storage, according to the report, is 7000 person-years more than for an equivalent nuclear plant. For wind systems with storage, 19,000 more person-years of work are created than are created by an equivalent nuclear plant. The report emphasized:

> The construction phase for both wind with storage and wind without storage would employ thousands of electricians, engineers, heavy equipment operators, laborers, steel workers and other construction personnel.[114]

MIT Professor David R. Inglis has determined that if windpower had a share of federal financial support commensurate with its promise, and if the money were spent "to encourage the rapid growth of a wind-turbine building industry," such an effort would utilize industrial facilities which already exist: motor companies which make gears, aircraft companies which make blades, electric companies which make generators.[115] The FEA Project Independence Study estimated that to generate 23% of the nation's electricity with wind power, 140,000 person-years of employment would be created by 1985, and 245,000 by 1990.[116]

That same report estimated that even a low level of electrical production by photovoltaic conversion would result in 3,344,000 jobs by the year 2000.

Carlough of the Sheet Metal Workers' Association reflected the frustrations of many regarding the slow pace of solar energy commercialization when he said:

> Dollars now being spent on fossil fuels from abroad would be better spent reducing joblessness by harnessing less expensive, inexhaustible energies at home. It is a national folly that, while the need for energy conservation and solar energy is so great, our sheet metal craftsmen, who can make energy-efficient buildings a reality, sit idle.[117]

Why, with the promise of solar energy so great, has progress been so slow?

The National Indian Youth Council is opposing construction of six commercial coal gasification plants on the Navajo Reservation in New Mexico. The Council points out that each plant will cost $1 billion, and will be obsolete in 25 years: "In 25 years, when the investment is paid off and the profits pocketed — the coal and the water gone — the remains will be a wasteland . . . The Reservation will be forced to accept unmanageable boom towns. . . . the plants will give labor to a few of the Indians — a doubtful benefit, considering the inevitable losses to the whole life and posterity of the tribe. . . . El Paso Natural Gas Company and Western Gasification Company will make the profit, but the consumer and taxpayer will pay for it all. Every dollar spent on the development of strip mines and gasification plants is another dollar that will not be spent on permanent and non-destructive alternate energy sources."

Source: National Indian Youth Council
Albuquerque, New Mexico

XI. The Politics of Solar Energy

In 1952, the Paley Commission noted:

> Efforts made to date to harness solar energy economically are infinitessimal. It's time for aggressive research in the whole field of solar energy—an effort in which the U.S. could make an immense contribution to the welfare of the whole world.[118]

SUDDEN ENERGY CUTOFFS AND JOBS

This winter's job layoffs due to natural gas curtailments provide unfortunate but revealing examples of what happens without sound energy planning and local control of energy sources.

The disruptions which occurred highlight how vulnerable the American people are to interruptions in energy systems which are controlled by corporate interests from far away. Although energy industries try hard to blame job losses due to closed businesses on government regulations and on environmentalists, it is clear that the shortages and job layoffs have been due to the gas industry's desire for higher profits. The gas companies simply have learned a lesson from the oil companies. (Or more accurately, from themselves. The five largest natural gas producers are Exxon, Texaco, Phillips, Gulf and Mobil; 18 of the nation's top gas producers are oil companies.)

Representative Clifford Allen (D-Tenn.) has observed that the gas industry is

> essentially a monopoly, controlled by a few rich, 19th Century-type robber barons—a monopoly that has no viable competition and permits no alternatives to which people can turn during these cold winter months.

There is increasing evidence of ample gas. Paul E. Reichardt, Chairman of the Washington Gas Light Company, said recently:

> The gas industry has reserves, proved and potential, to carry it well into the 21st Century.

But the gas was not made available to the public when it was needed most.

Charles Armin, Director of the Oil, Chemical and Atomic Workers District 1, recently told Southern California labor leaders that he is

> really disturbed that industrial people are blackmailing us, saying that unless you pay more, we'll not provide the energy anymore . . . A lot of our problems of job dislocations are caused by the fact that we haven't met someone's price. We need to be careful we don't create windfall profits for the oil and gas companies. Look how much industry can increase profits by little price manipulations.

Indeed, gas company profits are up considerably. They are up because of the increased use of gas and the higher costs for gas over the past six months. Gas company profits have been increasing almost as much as the oil company profits increased following the 1974 Arab oil embargo.

Gas producers do not seem to be reluctant to admit what is going on. David H. Foster, executive Vice President of the Natural Gas Supply Committee, an industry lobby group, has said:

> There are 7000 natural gas producers out there waiting for a signal that will provide them with the incentive to get out the rigs and lease the land.

The implication of this statement is that frozen people, closed factories and a disrupted economy are somehow not "incentive" enough.

One of those gas producers, Antonio Sanchez of Texas, expressed his views on the naivete of the public:

> What amazes me is why people in the East cannot understand the simple economics of it. Why should I sell my gas out of state at $1.42 [per thousand cubic feet] when Texas buyers are waiting in line to pay $2 for it?

The lesson for the public from all this is that local and regional energy systems must be developed which are responsive to the needs of consumers, and which cannot be interrupted when absentee corporate leaders decide to increase their profits, or indulge in any of their other whims.

Sources: *Washington Post,* February 7, 1977; Los Angeles Federation of Labor Energy Conference, Jan. 1977; *New York Times,* January 21, 1977; *Wall Street Journal,* February 3, 1977; *Dollars & Cents,* March, 1977.

courtesy: *Washington Star*

According to the Senate Select Committee on Small Business, the Paley Commission's enthusiastic predictions and their recommendations went "tragically unheeded." And more than 20 years later, new studies for the government done by the General Electric Corporation, by Westinghouse, and by another large energy company—TRW—predicted that the energy contributions of solar technologies by the year 2000 would be minimal: General Electric's figure for solar heating and cooling was 1.6%; Westinghouse's was 3.14%; TRW's was 5.77%.[119]

Senator Gaylord Nelson (D-Wis.), noting that these solar projection studies were performed by companies heavily invested in nuclear power, coal, natural gas and oil, commented:

> The suspicion is unavoidable that these and other absurdly low estimates of the solar contribution during the next 25 years are not of what the estimators think the country *could* do if it put forward anything like the money and effort that went into nuclear development or moonshots, but rather what they hope the country *will* do. Not because doing so little is in the best interests of the great majority of Americans and other people of the world, but because doing so could possibly threaten existing investment in other technologies.[120]

James Piper, President of the Piper Hydro Company, testified before Senator Nelson's Committee on Small Business:

> I do not think Westinghouse can put its heart and soul into producing a good solar system.[121]

Jerry Plunket, a solar businessman from Colorado, noted the difficulties of dealing with the federal government on solar energy matters:

> Rather than assisting us, we have found federal employees unable to understand the solar-state-of-the-technology, unable to formulate reasonable plans for moving solar technology ahead, and in fact engaging in projects that were designed to keep university professors employed and off the street, and to use study contracts granted to large firms to make solar energy appear long term, remote and unlikely to respond to our current energy crisis. Further, incredibly expensive solar heating experiments were conducted that seemed designed to explore the upper bounds of costs —not to demonstrate cost effectiveness.[122]

The FEA Project Independence Task Force found that among "factors which have inhibited" the growth of solar systems were: (1) a lack of federal or private industry interest, and (2) underpriced, taxpayer subsidized fuels.[123]

An excellent example of federal indifference to solar energy development occurred recently in Fairfax County, Virginia. A school was completed there which is 100% heated and cooled by solar energy—the nation's first. Fairfax was unable to obtain government assistance for this project, so it sought money for a long time from other sources. Finally, the county received some funds from a university—in Saudi Arabia.[124]

Government officials frequently say that modest sums appropriated for solar energy are as much as can be prudently spent, given the state of the art. They say that a "new" industry can progress only a little at a time. But on some occasions when this country needed vigorous action, even the federal bureaucracies and private industry responded. For example, when specialized aircraft were needed during World War II, the fledgling aircraft industry was able to increase production from 3,623 in 1938 to 96,318 in 1944. See table IV:

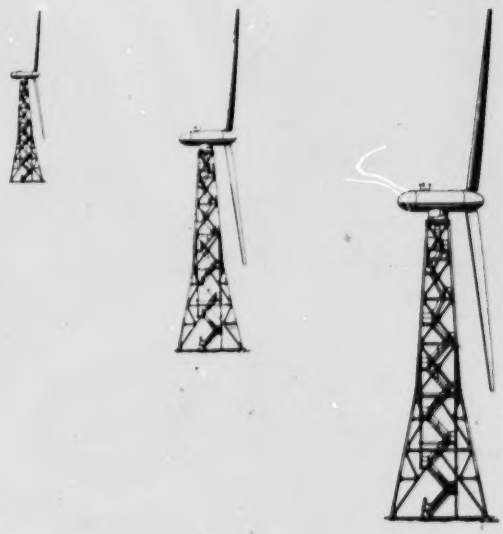
TABLE IV[125]

AIRCRAFT PRODUCTION IN THE U.S., 1938-1944

Year	*Number of Aircraft Produced*
1938	3,623
1939	5,856
1940	12,804
1941	26,277
1942	47,836
1943	85,898
1944	96,318

The FEA concluded:

It is assumed that wind energy systems are not more difficult and probably far less difficult to produce than World War II aircraft.



No federal funds went to solar research and development prior to 1970. Since then, the solar budget has been increased each year. See table V:

TABLE V[126]

FEDERAL SOLAR BUDGET, 1970-1977

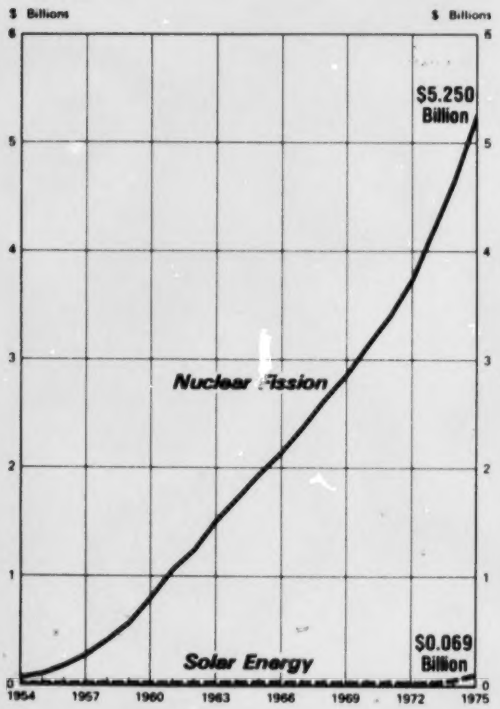
year	*allocation*
1970	$ .2 million
1971	1.2 million
1972	1.7 million
1973	4.0 million
1974	15.0 million
1975	43.0 million
1976	114.6 million
1977	290.0 million

Although the percentage increases of each year may seem large, the total dollar amounts allotted are nonetheless puny, especially compared to federal allocations for other energy areas.

The following chart compares allocations of federal funds to solar and nuclear technologies:

CHART III[127]

FEDERAL EXPENDITURES FOR SOLAR ENERGY AND NUCLEAR FISSION



The proposed fiscal year 1978 ERDA budget of the Carter Administration provides clear indication of federal priorities in energy research and development:

TABLE VI[128]

PROPOSED ERDA BUDGET FOR FISCAL YEAR 1978

program	*budget outlay*
conservation	$244 million
fossil fuels	519 million
solar heating and cooling	86 million
solar electric and others (mostly centralized solar thermal technologies)	164 million
nuclear fusion	392 million
nuclear fission	137 million
nuclear fuel cycle and dangerguards	486 million
liquid metal fast breeder nuclear reactor	651 million
management and support (ERDA bureaucracy)	306 million
uranium enrichment	441 million
nuclear weaponry	1 billion, 913 million

If one combines the various categories involving nuclear fission and solar energy, the total ERDA energy research and development budget looks like this:

TABLE VII[129]

technologies	*budget outlays*
conservation	$244 million
fossil fuels	522 million
solar	250 million
fusion	392 million
fission	one billion, 715 million

The Carter Administration has doubled the outlays requested for conservation, increased the solar request slightly, and decreased the funds requested for the liquid metal fast breeder nuclear reactor demonstration project by about one-third, compared to the Ford Administration's fiscal year 1977 budget. But other categories of nuclear fission were increased, and nuclear fission absorbed about 40% of ERDA's budget increase, according to Tom Cochran of the Natural Resources

SOLAR STRATEGY AT ERDA

Some ERDA officials have expressed concern about investing taxpayer money in solar technologies without being sure what the returns will be. They—along with multinational energy corporations—seem to be suggesting that if the nation is going to put money into solar energy, at least it should be directed toward developing huge, centralized, expensive energy systems which only the corporate energy industry can handle.

The Carter Administration has bestowed on the new ERDA solar budget a mere cost-of-living increase over Ford Administration fiscal year 1977 budget levels. The majority of the new solar budget is directed to research and development of centralized solar electric systems (with some new funds for biomass conversion programs). The money for centralized solar research and bioconversion is not being taken from the vast sums alotted to nuclear fission, fusion or synthetic fuel development. Instead, the money is being withheld from research and development of other solar technologies which could be put to use more quickly, provide greater quantities of energy, and could be installed and controlled by small business, communities and individuals: heating and cooling of water and buildings, along with wind energy and photovoltaic systems.

It is commendable that ERDA is concerned about its responsibility for taxpayer dollars, and that it is seeking to evaluate how its solar programs are doing. After twenty-five years and tens of billions of taxpayer dollars have been poured into nuclear fission and fusion development, it would be nice to see similar concerns expressed about continuing investment in these realms as well.

But wishful thinking aside, ERDA needs to be prevented from playing musical chairs with the solar energy budget, alternately sacrificing one advantageous solar technology for another, while investing in centralized solar systems and continuing to pour vast sums into nuclear and other exotic technologies.

Source: Robert Hirsch, former Assistant ERDA Administrator for Solar Energy; Tom Cochran, Natural Resources Defense Council, *An Analysis of the Carter Administration's FY 1978 ERDA Budget,* Washington, D.C.: February 7, 1977.

Defense Council.

President Carter's proposed funding of nuclear fission and nuclear fusion technologies thus ends up about **four times** that of conservation and solar technologies combined, despite the significant advantages in economy, employment, safety, and near-term feasibility of conservation and solar energy.

Conclusion

A recent perceptive ERDA report has recognized that among other aspects of the nation's energy dilemma, unwarranted "fear of unemployment is a key political fact."[130] This will be true as long as energy monopolies insist on threatening economic depression and unemployment if their expansion of vast, complex, costly and centralized energy systems is not permitted to continue.

To be sure, jobs will trickle down as a result of investment in wasteful and dangerous energy systems. ERDA has estimated that the current total employment in nuclear fission electric activities is about 80,000 people: mostly engineers, mathematicians, physical and earth scientists, technicians, welders, plus "all other employees."[131] Getty Oil Company's Nuclear Fuel Service Facility, between 1966-1971, employed an average of 1400 temporary workers each year at radioactive "hot spots." To locate, repair and insulate six 4½ inch hot water pipes in radioactive areas of a nuclear reactor, Consolidated Edison Company brought in 1500 welders, each of whom worked 15 minutes until he had received his maximum permissible dose of radiation. Professor Irwin C. Bupp of MIT has calculated that proposed floating nuclear power plants will create jobs beyond those created by land-based nuclear plants—jobs in hull scraping and ferrying.

Promoters of ever-expanding deployment of nuclear and other huge energy systems as the primary means of providing employment and prosperity (such as *Americans for Energy Independence*) try hard to portray those seeking energy efficiency and the commercialization of solar technologies as being against "economic growth . . . workers, the poor, and the disadvantaged."[132]

But it is the energy expansion scenario, which wastes both capital and resources, provides only limited jobs and unreliable energy sources, which causes disease and environmental destruction, which is not in the interests of "workers, the poor and the disadvantaged," or in the interests of anyone else except the large energy corporations themselves. There are more jobs by far—and safer jobs, and there will be greater prosperity more evenly distributed if the nation cuts back significantly on energy waste and moves vigorously toward solar energy. There will also be much less social and political havoc arising from this path to energy sufficiency.

Clearly, those who seek this solution do not seek an era of freezing and starving in the dark. They envision just the opposite: a time of decreasing dependence on foreign countries and on vulnerable and speculative energy systems; a time of abundant jobs and healthier people who live amidst cleaner air and water; and a time when people have greater control over their own lives and more resources with which to obtain the goods and services which make living easier and more enjoyable for all. A fair and equitable transition to a conservation and solar economy, during which no group or class of people will be made to bear the burdens of changing social values and technological innovations, would mean that the entire society would benefit greatly.

Energy corporation supporters try to suggest that the average American has no business getting involved in energy problems and solutions. *Americans For Energy Independence*, for example, advises citizens to defer to "representatives" in government, labor and industry:

> But [proponents of limited energy growth] do not hold positions that would make them accountable for the consequences of limiting the country's economic growth . . . On the other hand, those representatives of government, labor and industry who have personal responsibility for maintaining the economic well-being of the nation and improving the quality of life for the workers, the poor, and the disadvantaged, are firmly convinced that economic growth should not be limited at all.[133]

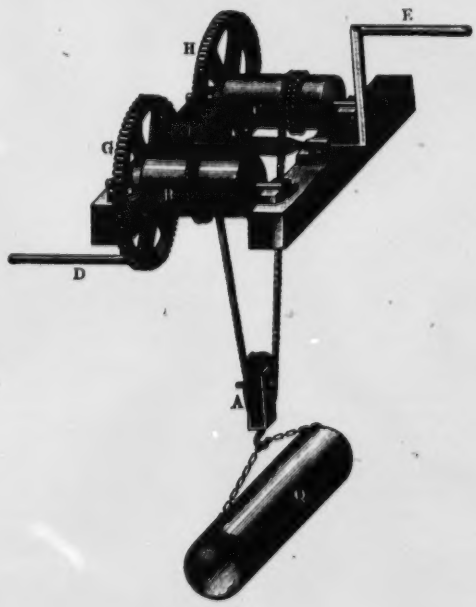
As has been demonstrated in the above analysis of energy and employment, there *are* representatives of government, labor and industry who know the great value of decreasing energy waste and maximizing the use of solar technologies, *especially* for the benefit of "the workers, the poor, and the disadvantaged."

But beyond this, the "responsibility" for the economic well-being of the country cannot be the special province of the country's leaders, as the fiscal year 1978 ERDA budget makes clear. On the contrary, *all Americans* share such responsibility. As the ERDA assessment of solar energy stresses:

> Solar energy is part of a broad societal choice involving much more than the selection of an energy technology.[134]

Indeed, these energy and jobs issues are components of basic struggles over political and economic power.

Many Americans are ahead of their leaders in understanding the causes of the nation's energy and unemployment problems. They are willing to seek solutions which may not necessarily coincide with corporate myths. They realize that energy efficiency and solar technologies are the methods by which the public can be assured that enough safe energy will be available; that the people will be able to control its production and use; and that there will be sufficient numbers of jobs available in diverse activities throughout a prosperous nation.



On the Poor and Disadvantaged

Energy industries say they must expand for the sake of the poor and disadvantaged. If energy industries were truly concerned about these people, they would be spending money to develop inexpensive, energy-efficient and long-lasting appliances. Yet, as Professor Herman Daly has pointed out, the industry spends *eight times* as much money on advertising as it does on research and development of energy-efficient consumer goods.

In addition, utilities would not be opposing affordable 'lifeline' utility rates, and would not be charging higher rates to the smaller users. They would not be opposing clean air and clean water regulations, since foul air and polluted water affect the poor more than those who can afford to escape to cleaner realms. They would not be fighting commercialization of safer, cleaner, cheaper solar energy systems and energy-efficiency techniques (which they usually fight with rate-payer money). They would not constantly be playing down the danger aspects of complex technologies like nuclear fission, coal conversion, the liquifaction and transportation of natural gas, which threaten the poor first and most. And they would not be misleading about where the jobs are.

Notes

1. The Congressional Budget Office, *The Disappointing Recovery*," Washington, D.C.: January 1, 1977.
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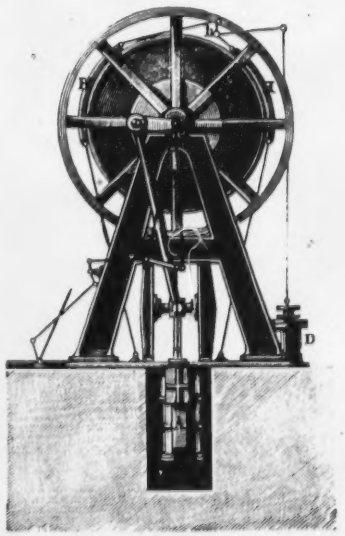

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